PATENT SPECIFICATION
DRAWINGS ATTACHED

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Inventor: CLEMENT ELPHICK GOSSLING

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International Classification:—**H 01** h 5/06.

COMPLETE SPECIFICATION

Improvements in or relating to Electric Switches

We, HONEYWELL LIMITED, formerly HONEYWELL CONTROLS LIMITED, a British Company, of Honeywell House, Great West Road, Brentford, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electric switches and more especially to the type of switch known as a toggle switch.

In electric switches it is generally desirable for the "make" and "break" actions to be effected as quickly as possible, particularly where the switch is carrying a D.C. voltage, and it is an object of the present invention to provide an electric switch in which a quick "make" and "break" action is effected without requiring a complicated and therefore less reliable switching mechanism to be present within the switch.

According to the invention there is provided an electric switch comprising a pair of electrically conductive two-armed levers mounted for tilting movement on two parallel pivots, respectively, each lever being permanently electrically connected to a fixed terminal and each having an inner arm extending between the pivots and an outer arm carrying a movable electrical contact which is co-operable with a respective fixed electrical contact upon tilting of the lever from an 'off' position to an 'on' position, and an operating member carrying a plunger which is resiliently biased towards the two levers, wherein the two pivots are fixed relative to one another and both inner arms contribute to the provision of a mechanical contact surface which bridges the two pivots when the two levers are both in the 'off' position, and along which surface the plunger can ride either in one direction or in the opposite direction to tilt either one lever or the other lever, respectively, to its 'on' position.

The plunger may move out of contact with either of the levers when it is operated to move the movable contact of the other lever into contact with the respective fixed contact.

In order to avoid a lever, which is not contacted by the plunger, being able to pivot freely on its own, each lever may be biased towards a position wherein its movable contact is out of contact with its respective fixed contact.

Alternatively, in order to prevent either lever from being left free to pivot on its own, the inner arm of each lever which extends between the pivots may be continuued far enough to remain in contact with the plunger even when the plunger is moved to make the movable contact carried by the other lever come into contact with the respective fixed contact.

One difficulty which has arisen in the construction of electric switches is that if the contacts should become lightly welded together, for instance by arcing, it should be possible to break this weld by moving the switch operating member. In order to achieve this desirable characteristic, in an electric switch of the invention displacement of the plunger against its bias is limited by a stop and the inner arm of each of the levers on which arm the plunger rides in order to move the movable contact out of contact with the respective fixed contact is so formed as to force the plunger against the stop if the plunger rides along that arm without initially pivoting the lever, whereby continued movement of the plunger by the operating member will produce non-resilient force on that arm to forcibly pivot the lever.

[Price 4s. 6d.]

In the preferred embodiment of the invention each inner arm is curved towards the path of movement of the plunger.

Also in the preferred embodiment each lever has an externally cylindrical conductive portion through which the pivot passes axially, and the fixed terminal has a portion provided with a concave cylindrical surface which mates with said cylindrical portion to provide electrical contact between the fixed terminal and the lever even during pivotal movements of the latter.

Preferably the plunger is or includes a roller which is spring-loaded into contact with the levers.

In order that the invention may be more clearly understood some embodiments in accordance with it will now be described by way of example with reference to the diagrammatic drawings accompanying the Provisional Specification in which

Figure 1 shows a partly cross-sectional view of a toggle switch in accordance with the invention

Figure 2 shows in the 'off' position, working parts of the switch shown in Figure 1

Figure 3 shows a detail of the switch shown in Figure 1, and

Figures 4 and 5 show on an enlarged scale an alternative lever arrangement for a switch such as is shown in Figure 1.

Referring to Figure 1 of the drawings, a switch is shown which comprises a casing 1 in the bottom of which are mounted three terminals 2, 3 and 4, which may for example be threaded terminals. The central terminal 3 carries a fixed terminal portion 5 which is provided with two concave cylindrical surfaces 6. The two terminals 2 and 4 are provided with respective fixed contacts 7 and 8.

Two electrically conductive levers 9 and 10 are supported on respective parallel pivots 11 and 12 which pivots pass axially through cylindrical portions 13 of the levers 9 and 10. The pivots 11 and 12 may be mounted with their ends supported by the casing 1. The concave cylindrical surfaces 6 of the fixed terminal portion 5 mate with the cylindrical portions 13 of the levers and thus provide electrical contact between the fixed terminal portion 5 and each of the levers even during pivotal movements of the levers 9 and 10 about their pivots 11 and 12.

The levers 9 and 10 each have two arms *9a*, *9b* and *10a*, *10b* respectively. The outer arms *9a* and *10b* are each provided with contacts shown at 14 and 15 which can be moved into and out of contact with the respective fixed electrical contacts 7 and 8 by pivoting the levers 9 or 10 in respective opposite directions.

The levers 9 and 10 are operated by means of an operating lever 16 which is pivoted at 17 on the casing 1, and which carries a plunger in the form of a roller 18 which is resiliently biased towards the levers 9 and 10, for example by means of a spring loading within the operating lever 16.

Each of the levers 9 and 10 is biased towards a position where its movable contact 14 or 15 is out of contact with its respective fixed contact 7 or 8, that is to say towards the position in which the lever 10 is shown in Figure 1. The bias may be provided by suitably placed small springs (not shown).

When the operating lever 16 is in the position shown in Figure 1 it will be appreciated that the spring loading on the roller 18 will hold the lever 9 in a fully anticlockwise position with its contact 14 in contact with the fixed contact 7. On turning the operating lever 16 anticlockwise about its pivot 17 the roller 18 will ride along the arm *9a* until it passes over the pivot 11. As soon as it has passed over the pivot 11, for example to the position shown in broken lines at *18a*, the spring loading on the roller 18 will cause the lever 9 to pivot in the opposite direction, i.e. clockwise, with a snap action so as to open the contacts 7 and 14. The levers 9 and 10 will then be in the positions shown in Figure 2 where the roller 18 is positioned between the pivots 11 and 12 in the trough formed by the two inner arms *9b* and *10a* which are curved towards the path of movement of the roller 18 for a reason which will be explained below.

By moving the operating lever 16 in the appropriate direction the roller 18 can be moved from the position shown in full lines in Figure 2 to ride along either of the levers 9 or 10 and in either case when the roller 18 passes beyond the respective pivot 11 or 12 its spring loading will cause the lever 9 or 10 to pivot with a snap action to close the contacts 7 and 14 or the contacts 8 and 15. The position of the roller 18 when this snap action occurs is illustrated in broken lines at *18b* in Figure 2.

It will be seen from Figures 1 and 2 that one arm of each lever, namely the inner arms *9b* and *10a*, extend between the two pivots 11 and 12, that is to say in a direction generally from one pivot towards the other. Furthermore, referring to Figure 3 which is a partial view of the two levers from above, the arm *9b* is forked and the arm *10a* extends into the fork. In this way, the arms of the levers 9 and 10 are so positioned that they form a mechanical contact surface for the roller 18, this surface extending from the extreme end of outer arm *9a* of the lever 9 to the extreme end of outer arm *10b* of the other lever 10. Thus the operating lever 16 can be operated to move the roller 18 at will between its central position (as shown in Figure 2) to one end position (for

example that shown in Figure 1) or the other end position and back again, and when it is in an end position it will close the pair of contacts 7, 14 or 8, 15 and when it is in the central position both pairs of contacts will be open as shown in Figure 2.

If, when the switch is in the position shown in Figure 1, the contacts 7 and 14 become welded together, for example by arcing, the lever 9 will not pivot when the roller 18 is returned to the position 18*a*. However the displacement of the roller 18 against its bias is limited by a stop 19 on the operating lever 16 which stop can be abutted against by a boss 20 in the centre of the roller 18. Because the inner arm 9*b* is formed with a curve towards the path of movement of the roller 18 it will, when the roller 18 reaches the position shown in 18*c* in Figure 1, force the boss 20 against the stop 19, provided the lever 9 has not pivoted, whereby continued movement of the operating lever 16 and roller 18 will produce a solid non-resilient force on the curved part of the arm 9*b* to forcibly break the weld at contacts 7 and 14 and pivot the lever 9 clockwise thus opening contacts 7 and 14. For the same reason the inner arm 10*a* of the lever 10 is also curved towards the path of the roller 18.

It has been mentioned that the levers 9 and 10 may be biased clockwise and anticlockwise respectively by small biasing springs so that neither lever will be allowed to pivot freely when the roller 18 has left it to operate the other lever. However, referring to Figures 4 and 5, these springs may be eliminated if that arm of each lever which extends between the pivots 11 and 12, that is to say the inner arms 9*b* and 10*a*, is continued far enough to remain in contact with the roller 18 even when the roller is moved to operate the other lever. In Figures 4 and 5 this continuation of the arm 9*b* is shown at 9*c* and the arm 10*a* is continued in a similar manner as shown at 10*c*.

Consequently when the roller 18 is in the position shown in full lines in Figure 4, not only does it tilt the lever 9 anticlockwise to close the contacts 14 and 7, but also it still bears on the continuation 10*c* of the arm 10*a* of lever 10 which continuation lies behind the arm 9*a* as shown in Figure 4. Thus the lever 10 is not free to pivot on its own but is held with its contact 15 away from contact 8 by the roller 18 bearing on the continuation 10*c*. The continuation 9*c* of the arm 9*b* of lever 9 acts similarly to hold the lever 9 in a fixed position when the roller 18 is moved on to the arm 10*b* of lever 10 in order to close the contacts 8, 15.

When the roller 18 is in the central position as shown in Figure 5 the levers 9 and 10 will be in the positions shown in that figure.

In the switch illustrated in Figures 1, 2 and 3 of the drawings the roller 18 will preferably consist of two cylindrical parts of relatively large diameter which lie on opposite sides of the lower end of the operating lever 16, and the boss 20, which is of smaller diameter, will join the two larger parts together and will be located in the notch of which the stop 19 forms the end part.

Instead of the bias on the roller 18 being provided by a spring within the operating lever 16 it may be provided by means of a plate which (referring to the switch in the position shown in Figure 1) extends horizontally within the casing 1 and is in contact with the top of the roller 18, the plate having a central slot through which the operating lever 16 passes, the slot being of a length sufficient to accommodate the full range of movement of the lever 16 and the plate being biased downwardly along the whole of its length by means of springs. The movement of the roller 18 against the bias provided by the springs pressing the plate down on to the roller may then be limited by providing abutments above the plate which limits its movement and hence the movement of the roller 18 in a direction away from the levers 9 and 10.

It will be appreciated that in the switches described, a rapid make and break action has been achieved. The "off" position is positively held because the roller 18 is spring-loaded into the trough formed by the curved arms 9*b* and 10*a* and futhermore these curved arms in conjunction with the stop 19 which limits the movement of roller 18 against its bias enables tack welding of the contacts to be broken by operation of the operating lever 16.

WHAT WE CLAIM IS:—

1. An electric switch comprising a pair of electrically conductive two-armed levers mounted for tilting movement on two parallel pivots, respectively, each lever being permanently electrically connected to a fixed terminal and each having an inner arm extending between the pivots and an outer arm carrying a movable electrical contact which is co-operable with a respective fixed electrical contact upon tilting of the lever from an 'off' position to an 'on' position, and an operating member carrying a plunger which is resiliently biased towards the two levers, wherein the two pivots are fixed relative to one another and both inner arms contribute to the provision of a mechanical contact surface which bridges the two pivots when the two levers are both in the 'off' position, and along which surface the plunger can ride either in one direction or in the opposite direction to tilt either one lever or the other lever, respectively, to its 'on' position.

2. An electric switch according to claim 1, wherein each lever is biased towards a position wherein its movable contact is out of contact with its respective fixed contact.

3. An electric switch according to claim 1 in which the inner arm of each lever which extends between the pivots is continued far enough to remain in contact with the plunger even when the plunger is moved to make the movable contact carried by the other lever come into contact with the respective fixed contact.

4. An electric switch according to any one of claims 1 to 3, in which displacement of the plunger against its bias is limited by a stop and the inner arm of each of the levers on which arm the plunger rides in order to move the movable contact out of contact with the respective fixed contact is so formed as to force the plunger against the stop if the plunger rides along that arm without initially pivoting the lever, whereby continued movement of the plunger by the operating member will produce non-resilient force on that arm to forcibly pivot the lever.

5. An electric switch according to claim 4 in which each inner arm is curved towards the path of movement of the plunger.

6. An electric switch according to any one of the preceding claims in which each lever has an xternally cylindrical conductive portion through which the pivot passes axially, and the fixed terminal has a portion provided with a concave cylindrical surface which mates with said cylindrical portion to provide electrical contact between the fixed terminal and the lever even during pivotal movements of the latter.

7. An electric switch according to any one of the preceding claims in which the plunger is or includes a roller which is spring-loaded into contact with the levers.

8. An electric switch constructed and arranged to operate substantially as hereinbefore described with reference to the drawings accompanying the Provisional Specification.

For the Applicants
R. A. BRIDE,
Chartered Patent Agent.

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2 SHEETS

PROVISIONAL SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

SHEET 1

Fig. 1.

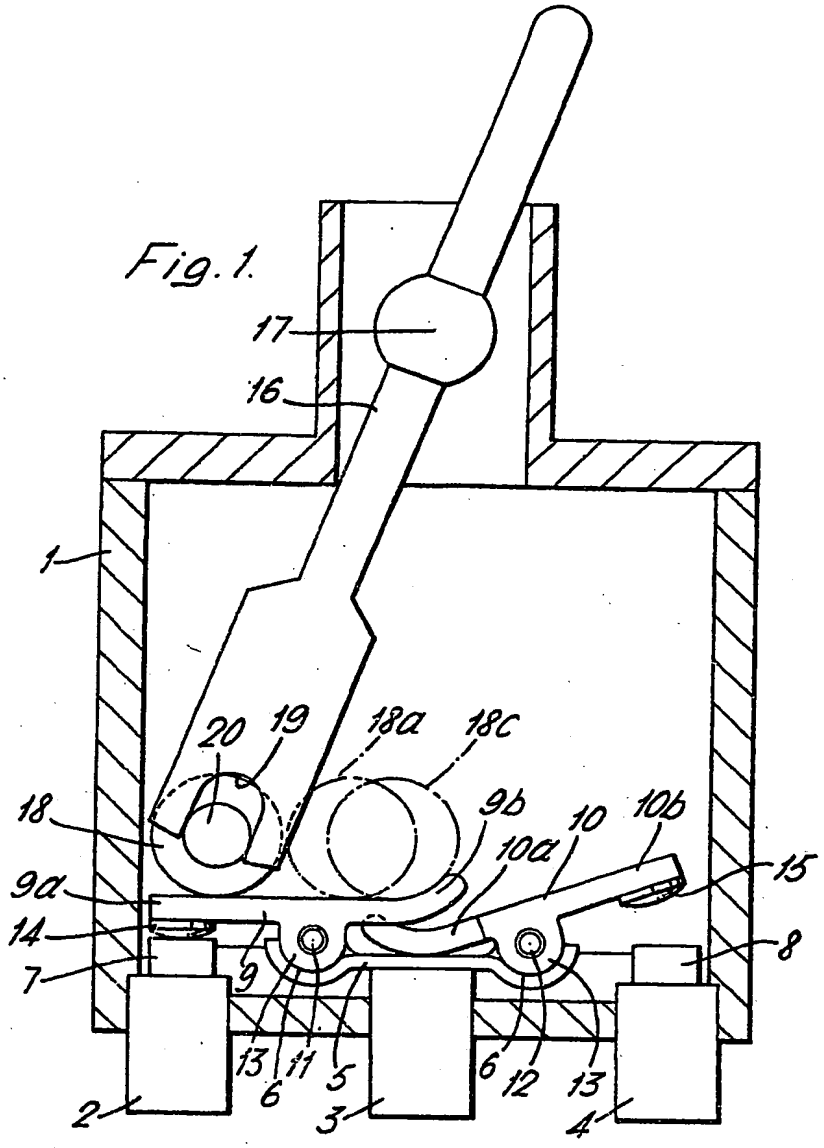
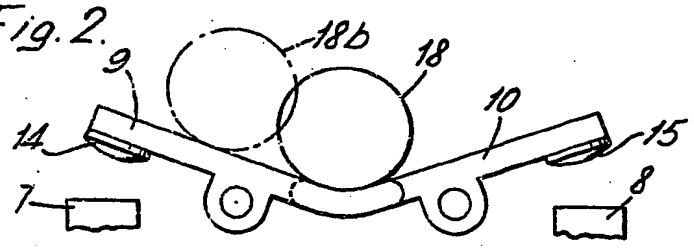


Fig. 2.



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PROVISIONAL SPECIFICATION

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SHEET 2

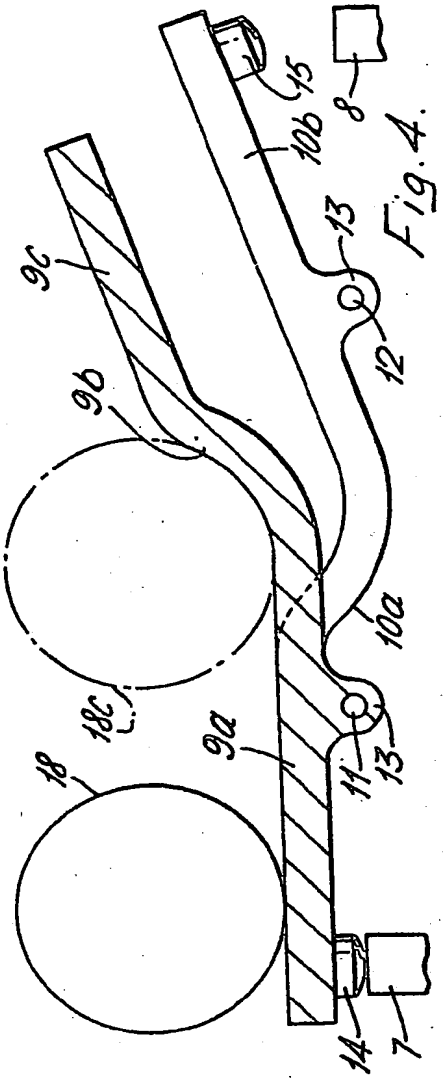

Fig. 4.

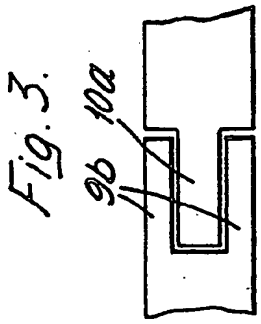

Fig. 3.

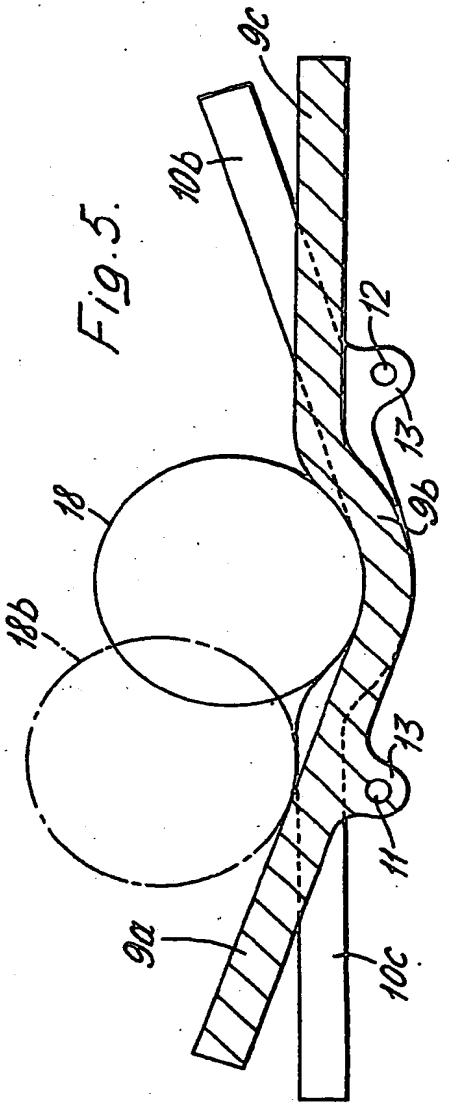

Fig. 5.